

With the Author's
Consent

ON THE PATHOLOGY OF CHOREA.

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WHILST recently engaged in examining the literature of chorea for some information on features of that disease which had excited my attention, I was somewhat surprised at the incomplete and unsystematic manner in which its pathology was generally discussed. There rarely appeared to be any attempt to explain the phenomena of chorea by a reference to the recent results of physiological and histological investigation, or to the now generally recognised views as to the nature and relations of the different varieties of nerve force. Nor was there much disposition to base the therapeutic measures recommended for the relief of the disease upon a rational statement of its pathology. I am induced, therefore, to draw attention to some considerations which may possibly serve to connect under a common head the scattered facts with which the various treatises on the subject abound, and may help to form a basis upon which to erect a more perfect theory as to the pathology of chorea than at present appears to exist. In order to make these considerations more clear, it will be desirable briefly to recapitulate some points in the physiology of nervous actions, upon an acquaintance with which the due appreciation of the nature of this disease intimately depends, but which do not seem to have attracted the notice of writers upon it.

All muscular movements in man are either voluntary or automatic ; those which are automatic being performed in virtue of what is called reflex nervous action, and involving the agency of a central reservoir of nerve force, a sensational impulse communicated to that centre, and a motorial one emanating from it. Automatic actions may be either independent of, or associated with consciousness ; where they are not accompanied by consciousness, they probably only involve the agency of the spinal cord,* or the gauglia of the sympathetic system ; where they are, the stream of nerve force which produces them must pass through the sensorium or centre of consciousness, which there are good grounds for supposing to be seated in the cerebral ganglia.† The faculty of the will, which is superior to and distinct from con-

* I put aside the idea of the possession by the spinal cord of a peculiar consciousness of its own, which has been raised, but which has found very few supporters.

† Dr. Carpenter's arguments in favour of this idea, and also of the supposition that there is but one seat both of intellectual and corporeal consciousness, seem to me sufficiently strong to warrant our receiving them as established theories. See *On the Functions of the Cerebrum*, in his *'Human Physiology.'*

seiousness, is not exercised in the creation of nervous impulses, as is generally supposed, but in the direction of those which are eonditioned by the extcnal phenomena of nature, or by the internal ones of our own mental economy. Hence it comes to regulate and control many movements which are essentially automatic in their character, and which exhibit themselves as such when the power of the will is withdrawn, with as much clearness as others over which the will, even in its most active state, has no influence at all. "Automatie," "instinctive," "involuntary," or, as they have been called, "reflex" movements, are induced, as has been stated, by the influence of a sensational impulse upon a nervous eentre, from which a motor impulse is transmitted to the muscles of the part acted upon. Such eentres are found in the ganglion eells of the spinal cord, as in the reflex movements of many of the lower animals, and in those which may be excited in the lower extremities of a paraplegic man; in the medulla oblongata, as in the movements of respiration and circulation in the higher animals; or in the sensory ganglia proper, as in the movements excited by the influence of stimuli transmitted from the organs of special sense, or of ideas proceeding from the grey matter of the cerebrum. Where the sympathetic ganglia act as centres of reflex action, their sensory impulses are probably derived from the bloodvessels and viscera to which their nerves are distributed. With regard to the immediate nature of the sensory impulse in these several instances, it may consist (1), of an ordinary sensation, produced by the influence of some stimulus upon the nerves of general sensibility, as in the case of the twitching of the legs of a paraplegic patient before referred to; or (2), of a special sensation transmitted by the nerves of special sense, as in the contraetion of the pupil induced by a bright light, or (in the case of the sympathetic, which to some extent may be looked upon as a nerve of special sense) as in the vomiting produced by irritation of the coats of the stomach; or (3) of an emotional sensation, as in the sudden start caused by a fright; or, lastly, it may consist of an idea, as in the vomiting induced by the idea of undulation and instability in a person who is seasick, and in whom the same effect may be sometimes produced by the remembered idea, even when on shore and at a distance from the sea.

The power of the will is exercised in a different degree over the automatic movements excited by these various kinds of sensory impulses. In health, greater command is exhibited by the will over the ideas than over the emotions, and these in their turn can be more easily controlled than the impulses derived from the special senses, and still more so than those derived from the sympathetic or the nerves of general sense. For instance, it is much less easy to restrain the impulsive activity excited by an emotional feeling than it is to curb that which is developed as the result of mere intelleetual considerations. The difficulty which is experienced in refraining from vomiting on inhaling a putrid odour is perhaps still greater. It is only under peculiar circumstances that the will can modify or resist impulses to motion derived from the sympathetic system, as is seen in the slight control we possess over the movements of the heart and alimentary canal, whilst

scarcely any one can keep his legs perfectly still when the soles of his feet are gently titillated. When the power of the will is enfeebled from any cause, not only do movements which were previously entirely subordinated to its influence exhibit their natural automatic character, but the susceptibility of the system at large to the excitement of reflex action, or what may be called its general reflex irritability, is at the same time proportionately increased, causes which in a healthily balanced state of the nervous powers would produce no disturbance in the regular discharge of their functions now coming into full play as disturbing elements. These rudimentary principles of physiological psychology, which I should have considered it unnecessary to recapitulate had they not been overlooked by most writers on chorea,* will enable us to perceive in what its nature consists. To facilitate their application, I will briefly enumerate the features which the disease presents.

The patient, in most cases a child or young person, is found to labour under muscular movements which are irregular in intensity, and more or less continuous. The attack can often be traced to a violent emotion—such as fright; or it has been preceded by anxiety, or some depressing mental influence. At other times it has commenced gradually, and its origin has been contemporaneous either with the appearance of some source of peripheral nervous irritation—such as worms, or dentition; or with some general disturbance of the system—such as the establishment of puberty, the temporary cessation of the menses, pregnancy, or an attack of rheumatism. The extent of the irregularity of movement varies in different cases; sometimes it is confined to one or both arms, or to one side of the body, the other being entirely free; or it may also invade the legs; whilst occasionally the trunk and all the limbs are involved in a succession of the most violent contortions. In the early stages of the disease, the mental functions, so far as the power of perception, memory, and judgment are concerned, are not obviously affected; but there is in all severe or chronic cases a taciturnity, which sometimes extends to almost complete inability to articulate; and some authors assert that long-existing chorea ultimately enfeebles the mental powers.† Not unfrequently, especially where the disease is of some standing, the moral faculties become affected, and the patient exhibits an irritability and mischievousness of disposition which is foreign to his or her natural character.

Such is a very brief outline of the principal features which chorea exhibits; let us see how far an examination of them will furnish a clue to its pathology. The movements are evidently involuntary; the patient never *wills* them, although in mild cases they may be partially restrained or modified by the will. But a patient labouring under the disease in anything like a severe form may be desired to hold his jerking arm still, and may apparently concentrate his whole mental

* Dr. Carpenter, to whose labours physiology owes so much, has in about half a page clearly pointed out the real nature of chorea, but has not entered into details, which would have been foreign to the object of his work. See his 'Human Physiology,' chapter on the Nervous System. Recapitulation.

† See Hamilton on 'Purgative Medicines,' Third Edition, p. 117; and Grisolle, 'Pathologie Interna,' Art. Chorée.

energies on that object, and he will fail to do so, not from want of the will to succeed, but because his power of volition is not sufficiently strong to overcome the impulses to movement which his arm receives from the nervous centres. The fault does not consist in a perversion* of the will, as has been sometimes erroneously represented, but in a diminution or abolition of it. In describing the movements of chorea as the result of perverted volition, many writers have obviously never closely studied them from nature; whilst others appear to have confounded consciousness and volition,† or to have supposed that the want of co-ordinating power, which choreic patients exhibit, is not dependent upon an enfeeblement of the will. That this inability to co-ordinate the actions of allied groups of muscles is really connected with the failure of the will is shown in those curious cases of brain disease where the first symptoms consist in an eccentricity and irregularity of gait, which is evidently dependent upon a deficiency of co-ordinating power, and which the patient, in the early stages of the affection, is able to remedy by concentrating his attention on the act of walking, and so intensifying the volitional impulse. By degrees, however, the will loses all control over the limbs, and complete paralysis, so far as voluntary motion is concerned, supervenes. But, after all, the want of co-ordinating power in chorea is more apparent than real; the eccentric movements of choreic patients being caused, as Hasse has noticed,‡ not so much by a want of co-ordinating power, as by the interpolation of involuntary motor impulses amongst the voluntary ones; to which, unless the will be called very strongly into action, they are superior in energy.§

The involuntary nature of the movements in chorea explains several features in the disease; one of which is, that even when most violent they are accompanied by little or no sensation of fatigue. In this respect they are no exception to the rule, that the more the will is exerted in the production of any set of movements, the sooner does that peculiar psychical sensation, indicative of nervous exhaustion, to which we give the name of fatigue, occur.|| The movements of the involuntary muscles rarely give rise to anything like fatigue; and those of the lower animals, who are continually occupied in the ingestion of food, are uninterrupted, from which we should infer that they are unaccompanied by any sensation of fatigue.

Another feature of chorea is, that those movements are least frequently affected which are mostly performed in an automatic manner. Thus, the legs are less frequently attacked than the arms, because the movements of the legs are much more automatic in their nature than those of the arms. The associated movements of swallowing and

* A little reflection on the nature of the will will convince any one that a "perversion" of it, in the sense intended by these writers, cannot exist.

† It is a point worth noticing, that whilst the movements of chorea come within the domain of consciousness, the stimuli to those movements, for the most part, do not.

‡ See his article on Chorea, in Virchow's 'Handbuch der Speziellen Pathologie und Therapie.'

§ The involuntary character of choreic movements is fully recognised by Bright, Grisolle, Romberg, Theophilus Thompson, Prochaska, and other writers of repute.

|| See Marshall Hall on the 'Diseases and Derangements of the Nervous System,' p. 26. Also Sir B. Brodie's 'Psychological Enquiries,' p. 14, Second Edition.

breathing are rarely affected. The reason of this probably is, that nature has provided against the cessation or irregularity of such movements as these, which are more or less essential to the well-being of the organism, by enduing them with an automatic character; and that the nerves, through which their activity is maintained, becoming habituated to the transmission of regular automatic impulses, present a less favourable means of exit for those unusual and irregular ones which are developed in chorea, than do the nerve-trunks, which supply purely voluntary muscles. That is to say, the nervous impulse, like the electric fluid, passes off by the best conductor, which in this case is the nerve to the voluntary muscle.

Both Séé and Grisolle bear out the assertion of some other writers, which my own experience also corroborates, that chorea generally commences in the left arm, and that the hemiplegic form most frequently occupies the left side.* The explanation of this is not very evident, unless it be referable to the fact that the left arm, and perhaps also the left side, is in most persons subordinate, both as to the frequency and activity of movement, to the right; as a result of which, its nervous organization may be radically weaker, and more liable to the influence of disturbing agencies.

The movements of chorea, then, are of a reflex nature. By what causes are they produced? In chorea, as in most constitutional diseases, we have two aetiological elements to deal with—the predisposing, and the exciting, or, to use a better term, the determining. Several phenomena of the disease help to throw some light upon these, one of which is its physiognomy. No one who has attentively observed cases of well-marked chorea can have failed to notice how closely they agree in their general aspect. They are eminently examples of what is called the nervous temperament. The clear, thin skin; the shy, averted glance; the bright, unsettled eye; the half-inquisitive, half-frightened look; joined with a frequent tendency to laugh or cry, and sometimes with an evident precocity of intellect, are enough to enable any one who has once noted these physiognomical indications of the disease to diagnose it at once, without looking to the limbs for information. So strongly has the physiognomy of chorea impressed itself on my own mind, that I rarely or never fail to recognise a case at first sight by these marks alone; and I should feel little hesitation in picking one out from a number of other patients who had not been, and were not likely to be, afflicted with that disease. Independently of the testimony of the physiognomy to their nervous diathesis, it will be frequently found, on investigation, that choreic patients are very liable to emotional impulses; and it is a well-known fact, that they are often gifted with high reasoning or imaginative powers. Dr. Samuel Johnson was a notorious illustration of this fact.

Another characteristic feature of the disease is the continuity of the movements, which in severe cases are uninterrupted even by sleep. By continuous, I mean that they do not increase and die off in a periodic

* "Dans la plupart des cas le trouble de la motilité commence par la moitié gauche du corps; et lorsqu'elle est partielle, elle occupe presque toujours le bras et la jambe du même côté, ou bien seulement le membre supérieur."—Grisolle, op. sup. cit.

manner, like some forms of nervous spasm; but that, with slight variations of intensity, they are constantly at work, one limb taking them up as they remit in another. There is a kind of mild chorea, which is pretty common in polite society, and which is known by the name of "the fidgets," though the subjects of it would probably not much like to be told that they were labouring under a modified form of St. Vitus's danee, and one which only differed from the more severe manifestation of the disease in being more under the control of the will. And it will be generally found, on inquiry from their friends, that patients previously to an attack of chorea have been very fidgetty subjects. These facts, then, seem to show that the nervous system of choreic patients is constantly generating a large amount of nerve force; and that the equilibrium between the tendency of this superusage of nervous power to escape by means of a motorial or emotional demonstration, on the one hand, and the restraining power of the will, on the other, must be much more delicate than it is in ordinarily healthy persons.* Whether we seek to illustrate this supposed state of things by an electrical metaphor, and speak of it as indicating a highly polar state of the nervous elements; or whether we have recourse to a less scientific simile, and compare it to the delicately-strung wires of an Eolian harp, which vibrate to faint breezes that would strike noiselessly on coarser instruments, it is a condition which it is by no means difficult to conceive. And supposing the same peculiarity of constitution to exist in hysteria, as from the nature of that disease, and from its frequent alliance with chorea, would not be difficult to show, the difference in the manifestations which it exhibits in the two diseases may be not unaptly compared to the difference between the convulsive ebullition of a boiling vessel of alcohol, and the continuous simmering of one filled with water. Or, perhaps, still better, by the difference between the disruptive spark given off from the rounded knob of a charged Leyden jar, and the continuous luminous brush which passes off from the same jar when a point is substituted for the knob.†

Another fact of much importance in estimating the predisposing element in chorea, is that its subjects are in by far the larger number of cases of the female sex and young. The nervous character of the female organism is sufficiently indicated by the emotional susceptibility of the sex, by the acuteness of their perceptions, and by their proneness to demonstrative actions. In the healthy female, the natural excess of nervous energy discharges itself at intervals in the various

* "The nervous system [of a healthy man] may be compared to an organ with bellows constantly charged, and ready to be let off in any direction, according to the particular keys that are touched. The stimulus of our sensations and feelings, instead of supplying the inward power, merely determines the manner and place of its discharge. The centres of speech and song, for example, when fresh and healthy, may either overflow so as to commence action in a purely spontaneous way, or they may remain undischarged till irritated by some external influence—as, for example, the sound of another voice."—Bain 'On the Senses and Intellect,' p. 291.

† Since writing the above, my attention has been called to the fact, that Dr. Todd has compared the paroxysm of epilepsy, which in so many respects resembles that of hysteria, to the disruptive discharge of the Leyden jar, when its charge has reached a certain measure of intensity—a simile, than which nothing could be more happy. See his Lumleian Lectures, in 'Medical Gazette,' May 18, 1849.

emotions, in the occupations of maternity, in the peculiarly feminine amusements of singing and dancing, or in some other form of activity. The nervous energy of children, too, keeps them in a state of perpetual movement from morning to night, which it is very prejudicial to repress; and in infants, where nature has not yet acquired the full use of the limbs as an outlet for her surplus nerve force, she relieves herself by those frequent and tumultuous fits of crying which, though they appear to betoken such severe suffering, in nine times out of ten are merely the safety-valve for the surplus energy before mentioned, and as undesirable to restrain as are the violent outbursts of the highly-wrought feelings in riper years.*

We are then, I think, warranted in assuming that the peculiarity of the constitution of choreic patients consists in a tendency to generate a constant excess of nerve force, which in their ordinary state of health, when the will is strong enough to restrain unusual muscular movements, finds a vent in emotional manifestations, in activity of body, or more rarely in intellectual efforts.† It is important to remember that such a constitution as this is radically a weak one: it is a state of chronic irritability, and like all irritable conditions, rapidly succumbs to exhaustion. The functions of organs whose irritability is heightened are performed with increased activity, but their energy is soon dissipated. The irritable heart, with its tumultuous throbings which simulate strength, is essentially a weak one. The man whose heart beats vigorously never feels its action. The irritable stomach is soon worn out. Repose, self-control, is pre-eminently the attribute of real strength. The difference between the two states—to recur to electricity for a metaphor—is just the difference between the charge of a Leyden jar and that of a galvanic battery. The effects of the one are more instantaneous and brilliant than the other, but it is not capable of that prolonged and steady activity which gives the latter its strength. Hence it is why chorea, like delirium tremens (to which it is closely analogous, the one being automatic motion, the other automatic ideation‡), in so many cases supervenes upon agencies which have a tendency to exhaust the general power or tone of the nervous system, and to increase its irritability; and hence, too, the efficacy of those medicines and hygienic appliances which act by restoring this loss of tone.

It would be interesting, if possible, to ascertain to what extent this peculiarity of constitution which is manifested by choreic patients is dependent upon hereditary influences, and what may be its relation to other diseases arising from a similarly ill-balanced state of the nervous faculties, such as insanity, epilepsy, and hysteria. There are many

* See Bain, *op. sup. cit.*, p. 76.

† This idea of a constant discharge of nerve force in the form of a stream passing out from the nervous centres into their trunks is illustrated, though to a much feebler extent, by the phenomenon of muscular tonicity; which, after the experiments of Marshall Hall, must be attributed chiefly to the continuous passage of nervous influence from the spinal cord into the muscles, manifesting itself in the form of a tonic contraction, which is almost, if not entirely, abolished by the destruction of the spinal cord, or the severance of the nerve-trunks leading to the muscles.

‡ Bouillaud has graphically called chorea “insanity of the muscles!” (*folie musculaire.*)

eases on record which show that the liability to chorea may be directly transmitted from parent to child. Bright instances several such, and Séé states that he has met with 18 cases of hereditary chorea. Dr. Begbie has also drawn attention to the interesting family relation which sometimes exists between chorea and rheumatism.*

Of the connexion between chorea and hysteria there is no want of examples, and of that between it and some other forms of nervous disease a good illustration is cited by Romberg,† of a girl aged twenty, suffering under severe chorea, whose grandmother had died insane, whose mother had been subject at every confinement to eclampsia, and at that time suffered from daily attacks of catalepsy, and who had herself had a slight attack of chorea at ten years of age. Here we have in one generation a disease consisting in a withdrawal of the ideational faculties from the control of the will, with no affection of consciousness—i.e., automatic ideation; in the second, a disease manifesting itself in the form of automatic clonic spasm, with loss of consciousness; and in the third, one consisting in automatic muscular discharge, with consciousness unaffected. This case, too, illustrates another feature of chorea, which shows how completely it is dependent upon a radical vice of constitution, and how strongly, when once evoked, it impresses its stamp upon the nervous system, and that is the great liability which it exhibits to recur, even after an apparently complete cure. Bright refers to a case in which there were four separate attacks of chorea in less than three years, followed by others at longer intervals; and every hospital physician must have had choreic patients come to him time after time to get rid of their old enemy.

Amongst predisposing causes, though of a nature secondary to nervous idiosyncrasy, must be classed those which tend to lower the general tone of the nervous system, such as cold, insufficient nourishment, mental exhaustion, and possibly meteorological influences. In reference to cold, I have noticed the greater prevalence of chorea in winter than in summer;‡ and it is generally stated by writers on the subject that it occurs much more frequently in northern than in tropical climates. The influence of protracted cold in these cases is probably exerted through the heart and circulation, by the retardation of which the blood is prevented from supporting the nutrition of the nervous structures so actively as in warmer weather; the cold, too, being unattended by that healthy reaction which follows the shock of the cold bath, when used for the cure of the disease. Of mental exhaustion, as a predisposing cause, cases are quoted by Romberg and others; and the same author also mentions two cases which appear to prove that certain states of the atmosphere may predispose to an attack of chorea.

Having established the nature of the predisposing causes which induce in choreic patients a proclivity to that disease, it remains to

* Hasse (op. sup. cit.) recognises the probability of the children of "nervous" patients, and of those who have suffered from nervous diseases, being more liable to chorea than others.

† Vol. ii. p. 60, Dr. Sieveking's translation for the Sydenham Society.

‡ Wicke, as quoted by Hasse, also corroborates this. Of 35 relapses of chorea observed by him, 13 occurred in spring, 12 in winter, 9 in autumn, and only 1 in summer.

examine the circumstances which determine its immediate supervention. These are all of the class of abnormal or increased sensory stimuli, and may be divided into those which affect the peripheral extremities of the nerves, and those which directly influence the nerve-centres. Of many of them consciousness takes no cognizance; they probably arise in that great visceral system of nerves of which our knowledge is so limited, and may reach no higher than the medulla oblongata. There are those which are dependent upon a disordered condition of the uterine functions; as in the chorea which comes on at the time of the establishment of puberty, or in those cases where the movements are increased during the occurrence of the catamenia; in both of which the concentration of the nervous energies of the sympathetic upon the uterine *nodus* may possibly act as a source of irritation. The chorea connected with amenorrhoea may be explained by the hypothesis that the matters retained in the vascular system by the non-performance of that function of elimination which the catamenial flow undoubtedly supplies, may act as direct irritants upon the nervous centres. In the chorea occurring during pregnancy, we have a more obvious source of nervous irritation; and this form of the disease is quite comparable with the eclampsia which so often supervenes in the latter stages of pregnancy, or during parturition, in patients who have exhibited a previous predisposition to nervous excitability: in both of which cases the presence of the foetus supplies the irritation requisite to account for the fits, which generally cease soon after delivery is effected.* Indeed, the close relationship which exists between chorea and hysteria, and the occasional violence of the latter, and of puerperal convulsions, show how powerful a source of reflex irritation the uterus may become, notwithstanding the fact that it is an irritation of which the patient is quite unconscious. These three forms of nerve affection also indicate how the same stimulus may produce in one patient disordered cerebration, in another, clonic muscular spasm, and in a third, continuous discharge through the muscles. In connexion with this branch of the subject, two or three recorded cases may be referred to, where nothing was found after death to account for the disease but a deposit of bony or tubulous matter in the fimbriated extremities of the Fallopian tubes.

Another class of peripheral exciting agencies is found in the alimentary canal, such as the first and second periods of dentition; the presence of worms; and the accumulation of morbid matters in the intestines. The way in which these causes operate is so well recognised in the allied affection, epilepsy, and is so completely analogous to that in which uterine irritation acts, as to need no further comment. Both of these classes of irritants are decidedly peripheral, and probably act through the sympathetic; but there are some cases of chorea where it becomes difficult to decide how far the irritation is central or peripheral. For instance, in chorea associated with rheumatism. There can be little doubt that the source of irritation here is a toxæmic one, as originally suggested by Dr. Begbie. That it does not depend upon the cardiac lesion is shown by the occurrence of chorea in patients who have suffered from rheumatism, in whom either valvular disease or peri-

carditis alone may have been present ; by cases where neither of these lesions can be detected, and the patients have not previously suffered from rheumatism, although that disease occurs at a subsequent period ; by the occurrence of rheumatism in some members of a family, and chorea in others (Begbie) ; and by the cure of chorea in patients with persistent valvular disease. Whether the blood-poison in these cases acts as an irritant upon the peripheral nerves in the various organs where it is brought into contact with them ; or whether it acts directly upon the nervous centres themselves, must remain a moot point. Cases of chorea which must be placed in the same category, are those which are described by some authors as arising after suppression of long-standing eruptions and discharges ; poisoning by lead and mercury ; and the previous occurrence of the eruptive fevers.

We now come to those exciting causes of chorea which are of a purely mental nature, where the disease can be traced to a violent impression upon the sensorium, acting in such a manner as to develop in it a fixed tendency to the production of emoto-motor or ideo-motor impulses. Common experience agrees in assigning to fright a very high place in the causation of chorea, a large per-cent of the cases having exhibited the first manifestations of the disease immediately after a sudden and violent emotion of fear. As far as my own observation goes, these cases differ from most others by exhibiting as great an intensity at the commencement as they do at any subsequent period of the disease. Here we have a powerful sensational impulse, such as is capable, even in perfectly healthy persons, of giving rise to temporary reflex movements, impressing itself either in the form of a fixed idea, or a constantly-recurring emotion, upon the cerebrum of patients whose nervous equilibrium is naturally delicate, so as to act for a long time as a centre of continuous irritation. How strong an influence an emotional idea may exert upon the brain, and how long it may continue to act as a stimulus to reflex muscular movement, is shown in cases where a powerful emotion, such as that of disgust at a very foetid odour, or a loathsome sight ; or a powerful idea—such as that which is left in the brain of persons who have been once violently sea-sick—will succeed in evoking involuntarily the desire to vomit long after the original cause has ceased to act. The emotion, or idea—for it is difficult to differentiate the one from the other—becomes fixed, as it were, in the brain, fading away slowly, like a badly-fixed photograph ; and as it fades, the reflex movements to which it gave rise also die off, unless—and this it is important to remember—they have existed sufficiently long to acquire the character of a habit. When this occurs, which it does in all chronic cases of chorea, in addition to the difficulty of re-establishing the disturbed equilibrium of the nervous system, we have to contend with that firmly implanted concatenation of nervous actions in which habits consist, and which it is so difficult to break.* The *modus operandi* of fright in these cases

* The important influence which habit exerts in fixing and intensifying the symptoms of chorea, and in modifying the success of treatment, cannot be too strongly insisted on. In no disease is this more marked, except perhaps in epilepsy ; in reference to which, Dr. Sieveking has some forcible and practical remarks in his work on 'Epilepsy and Epileptiform Seizures,' p. 171.

is analogous to that of shock in concussion of the brain, lowering the tone of the whole nervous system, lessening the power of the will, and bringing into undue prominence automatic modes of action. Hence we can understand why fright is not only one of the most common, but also one of the most efficient exciting causes of chorea; for at one blow it breaks up the delicate equilibrium of the nervous system, depresses the power of the will, and leaves on the brain an impression which acts so long as it lasts as a constant stimulus to those automatic impulses of which the diminution of the will facilitates the establishment.

In addition to fright, other determining causes of a precisely similar nature, though inferior in intensity, are more rarely met with, such as "anxiety, dread of impending occurrences, concealed mental impressions, morbid exercise of the imagination, jealousy, envy, &c.,"* all of which involve the presence of a fixed idea or emotion as the source of the involuntary impulse. In connexion with the ideo-motor origin of the movements in chorea, two well-known features of the disease may be noticed—the increased activity of the motions whenever the patients are observed by strangers, and their cessation during sleep. The first of these phenomena may be accounted for in two ways: either by supposing the increased activity to be due to the patient's attention being directed to the movements from a consciousness of their eccentricity, and so acting as a stimulus to the changes going on in the nervous centres, just as it does in the increased intolerance—i.e., tendency to reflex action, induced by directing the attention to an itching of the skin; or by referring it to the influence of the emotion of embarrassment in exaggerating the emotional impulse already present.† The reason why the movements are arrested during sleep is, to some extent, because the attention is entirely withdrawn from them. Their activity during waking hours is greatly exaggerated by the attention being constantly fixed upon them, and when they continue by night as well as by day it is because the vigour of the reflex impulses is sufficiently great of itself to be independent of the intensifying influence of the attention. Dr. Marshall Hall states that in patients who dream much the movements not unfrequently continue during sleep, although the disease may not be of a severe character.‡ In these cases the unconscious cerebration in which dreaming consists serves to maintain the motor impulses, just as in non-choreic patients it may originate them. The more weighty reason, however, for the cessation of the movements during sleep is the great diminution of activity throughout the whole nervous system which takes place at that time, and the concurrent impairment of its sensibility to impressions which in waking hours would produce a marked disturbance in its functions.§ Another feature of the disease, which illustrates the possible ideo-motor origin of its movements is its occasional development by imitation (Grisolle, Bright, Watson)—that is to say, from the observation of

* Dr. Theophilus Thompson, in 'Library of Medicine,' Art. Chorea.

† Romberg, op. sup. cit., vol. ii., p. 59.

‡ So also does Hasse, loc. sup. cit.

§ "This state [sleep] involves the diminution of the mental functions. Sensation, perception, volition, are at their minimum."—Marshall Hall, op. sup. cit., p. 25.

a patient affected with chorea the idea of movement may become so strongly impressed upon the brain of another person, in whom a natural predisposition to the disease exists, as to lead to the development in him of automatic movements similar to those of the person first affected. This is one of the facts which show the relationship existing between chorea and hysteria, and it also indicates the propriety of separating severe cases of the disease from milder ones, in whom it might become intensified from the mere force of imitation ; and also from patients in whom, from their temperament or other reasons, the development of chorea might be anticipated.*

In addition to the foregoing well-recognised aetiological elements of chorea, there is another, the possibility of which is worth noticing. It is believed by many psychological writers† that much of the spontaneous muscular activity of the healthy organism, especially in young, "fresh," or over-fed animals, is to be attributed to a stimulus residing in the muscular system itself, which serves to call the super-abundant energy of the nervous centres of such animals into action by exciting a demand for its discharge through the nervous trunks by which the muscles are supplied. To this stimulus the term "muscular consciousness" has been applied. It is not improbable, judging from analogy, that this sensation, or stimulus of spontaneous activity, may, under certain circumstances, become morbidly exaggerated, in which case it might lead to the production of chorea. If such an hypothesis be admissible, we shall then have another peripheric source of nervous irritation as a cause of chorea, acting in the same way as, though of a totally different nature from, those before considered. Further, since the state of tonicity of the muscles must greatly influence the extent to which they are affected by stimuli proceeding from the nervous centres, a diminished state of tonicity probably accompanying an increased sensibility to the influence of stimuli, as is seen in some cases of paralysis ; and, as this tonicity is to a great degree dependent upon the automatic activity of the spinal cord, it becomes a question how far an abnormal state of sensibility to muscular stimuli, such as is exhibited in chorea, is dependent upon diminished activity of the spinal cord. Supposing this to be the case, we shall have a condition of diminished, or *negative*, activity in the spinal cord, and one of increased, or *positive*, activity in the sensorial centres at its apex, giving rise to a polar state of the cerebro-spinal axis, in which the upper part is + and the lower -.

The general principles upon which the treatment of chorea should be conducted are so well understood, that it is unnecessary to refer to them at any length ; but there are one or two points growing out of the preceding considerations upon which a few remarks may not be out of place.

Before all things, then, it is important not to forget one fact which the experience of all competent observers tends ineontroversibly to

* The influence of imitation in the production of chorea is illustrated in the history of those curious epidemic forms of the disease—the *morbus saltatorius*, or chorea proper, of the Middle Ages. See 'Cyclopædia of Medicine,' p. 205.

† See Bain, op. sup. cit., p. 76, for a discussion of this subject.

prove—viz., that in the large majority of cases chorea will, under favourable circumstances, get well of itself. The success which has attended the numerous and often antagonistic plans of treatment employed in the disease, would of itself be to some extent a *prima facie* proof of this.* Though it cannot be denied, that occasionally in uncomplicated cases of recent origin the disease may, by judicious treatment, be almost suddenly arrested. But more often the only result which can be accomplished, and the only one which the discreet practitioner will seek by therapeutic means to attain, is by removing the obvious sources of extrinsic irritation, and by stimulating those functions of the economy which seem best calculated to restore to the nervous system its healthy balance, to allow the *vis medicatrix naturæ* to work out her own cure in her own time. It wants no very profound reflection to be convinced that the treatment of chorea should be partly medicinal and partly mental: partly directed to the re-establishment of those functions, as of the uterus, upon whose imperfect performance the exciting element of the disease may depend; and partly to the regulation of those psychical processes in whose perversion its essence consists. When worms are present in the alimentary canal they must be removed. When the uterine functions are at fault they must be rectified. The beneficial effects of moderate purgation, as a general plan of treatment, are admitted by most authors. They are dependent upon the removal of irritating matters from the intestines, the removal of toxæmic matters from the blood, or, in cases of amenorrhœa, the influence which judicious purgation exerts in promoting the catamenial flow. Of the special tonics, iron, arsenic, zinc, and quinine have each their advocates, and the utility of all may be well conceded, though in individual cases one or other may be more especially advantageous—a point which is only to be determined by tentative observation. As a general tonic, the cold shower or douche bath stands in deservedly high estimation, its beneficial influence probably depending in part on the stimulus it gives to all the processes of nutrition through its action on the surface of the body at large, and in part to the healthy shock which it produces, and which breaks the chain of nervous impulses by which the disease is maintained. The great waste of tissue which must follow the constant muscular movements, the generally anæmic and ill-nourished aspect of the subjects of chorea, and the beneficial effects of hospital dietary, independent of strictly medicinal treatment, all point to the necessity of promoting by a full supply of nutritious and easily assimilated food, the various histogenetic processes. It is only to a judicious combination of these several elements of the treatment that the disease yields with rapidity; and nothing but a careful study of the individual peculiarities of each case can determine whether any, and which, should have the priority over the others.

On the psychological treatment of chorea I wish to lay more stress, not only because I believe it to be equally important with the medicinal, but because it appears to be so generally ignored, not one author in ten bestowing more than a passing word on it. A recurrence to

* See Sir James Bardsley's ' Hospital Facts and Observations,' p. 152.

what has been previously said on the nature of the disease will show that the indications which we are called upon to carry out in this branch of the treatment are three—viz., to withdraw the attention of the patient from the abnormal character of his own movements, i.e., to enable him to get rid of his diseased consciousness ; to break the incessant chain of nervous impulses which is transmitted through the cerebro-spinal axis, and to remove the dominant idea which appears often to exist in the cerebrum ; and to restore the enfeebled power of the will to its healthy control over all the other nervous functions. No plan of treatment is better calculated to fulfil all these conditions than a well-arranged course of gymnastic exercises, or even the use of the dumb-bells and skipping-rope. The dormant power of the will is aroused and brought forcibly and continuously into play. The habitual involuntary movements are replaced by periodic voluntary ones. The attention of the patients is abstracted from the morbid self-contemplation which is always weighing upon them. And the activity of the circulation, and with it that of all the functions of the body, is in every way promoted. In chronic cases, or where the movements are violent, some little difficulty will be experienced at first in getting the patients to undertake active exercise of the kind recommended, and in overcoming the idea which possesses them of their inability to carry it out, but a little perseverance will seldom fail to effect this. Although my own experience is not at present sufficiently large to allow me to speak positively upon this point, I feel but little doubt that by the constant use of a well-devised system of muscular movements, the duration of most cases of chorea may be reduced much below the present accepted average.

It is unnecessary to insist upon the patients being sent as much as possible into the fresh air, or upon the general utility of judicious moral treatment. These are points which must commend themselves to the attention of every thoughtful practitioner.

In conclusion I trust that I may be permitted to express the hope that the time is not far distant when a gymnasium will be considered as essential a part of every well-furnished hospital as a bath-room or a dispensary. No one who has watched the slow progress of convalescence in hospital wards, but must have felt how much it might often have been expedited by the aid which such a department would afford. Time will undoubtedly ere long bring back to us the appreciation of many of those physical appliances in which the medicine of antiquity was so rich. It may, perhaps, require some little courage to replace the time-honoured drugs with their complicated formulæ, and too often obscure modes of action, by the simple and inexpensive applications in which the therapeutics of the ancients consisted. But it is an exchange which will be well rewarded in many cases, and not least in this, if it teaches us that simplicity is not only the aim of all science, but the consummation of the highest art.

